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***Rediviva (Rediviva) parvoides* nov.sp. (Hymenoptera: Melittidae), a new oil-collecting bee species from western South Africa**

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A b s t r a c t: A new South African endemic, floral oil collecting bee species is described: *Rediviva (Rediviva) parvoides* KUHLMANN nov.sp. ♀♂. The new species and the closely related *Rediviva (Rediviva) parva* WHITEHEAD & STEINER, 2001 are imaged to facilitate their identification.

Key words: *Rediviva*, new species, taxonomy, oil-collecting bees, South Africa.

Introduction

The bee genus *Rediviva* FRIESE, 1911 is endemic to South Africa and Lesotho and currently comprises 33 species (KUHLMANN et al. 2020). Except for the subgenus *Redivivoides* MICHENER, 1981 (KUHLMANN 2012b) females collect floral oil and display a close evolutionary relationship with their host plants (e.g. STEINER & WHITEHEAD 1990, 1991, KUHLMANN & HOLLENS 2015, PAUW et al. 2017, HOLLENS et al. 2017, HOLLENS-KUHR et al. 2021, MELIN et al. 2021). The unique biology and evolution of *Rediviva* also resulted in detailed and ongoing taxonomic studies (e.g. WHITEHEAD & STEINER 2001, WHITEHEAD et al. 2008, KUHLMANN 2012a, b, MELIN & COLVILLE 2022, KUHLMANN 2024) and based on a molecular phylogenetic analysis (KAHNT et al. 2017) the subgeneric classification was recently clarified (KUHLMANN et al. 2020) making *Rediviva* one of the best investigated bee genera in Africa.

Thus, the discovery of a new *Rediviva* species in the Nieuwoudtville area came as a surprise because in that region these bees presumably have been most intensely collected and studied for many years (e.g. WHITEHEAD & STEINER 2001, KUHLMANN 2015, KUHLMANN & HOLLENS 2015, HOLLENS et al. 2017, HOLLENS-KUHR et al. 2021). Here, descriptions and photographs of key features of the new species *R. parvoides* nov.sp. and its close relative *R. parva* WHITEHEAD & STEINER, 2001 are provided to facilitate their identification and further studies.

Material and Methods

Terminology used in the descriptions follows those of MICHENER (2007). T is used as abbreviation of metasomal tergum and S for a metasomal sternum. Body length is measured from the vertex to the apex of the metasoma. Puncture density is expressed as the relationship between puncture diameter (d) and the space between them (i), such as $i = 1.5d$ or $i < d$.

Images were taken with a digital microscope (Keyence VHX-5000) using the VH-Z20R/Z20T (20x to 200x) zoom lens and the OP-42305 super diffused illumination adapter. Images were stacked for extended depth-of-field and processed using Adobe Photoshop Elements 2021 (Adobe Systems Software Ireland Limited, Republic of Ireland) and then assembled into figure plates. To facilitate identification, specimens of both species from neighbouring populations on the Bokkeveld plateau are imaged (*R. parva*: Farm Papkuilsfontein. *R. parvoides*: Farms Zoetfontein (only ♂♂) and Avontuur) to illustrate local colour variation in the overall highly variable *R. parva*.

Specimens housed in the Iziko South African Museum, Cape Town, were not available to the author for direct study. Instead they were examined by Dr. A. MELIN, Compton Herbarium, South African National Biodiversity Institute, Cape Town. Only a small proportion of the *R. parva* males in the collection were dissected, so that only a few specimens from Clanwilliam, Eendekuil, Hopefield and Stellenbosch could be examined for genitalia and S7.

Specimens of the new species are deposited in the research collection of M. Kuhlmann, Zoological Museum of Kiel University, Kiel, Germany (RCMK) and the Iziko South African Museum, Cape Town, South Africa (SAMC).

Permits for fieldwork and wild bee collecting in South Africa were granted by Northern Cape Department of Environment and Nature Conservation for Northern Cape Province (025/2002, 056/2003, 0055/04, 0332/05, 0648/06, 0317/07, FAUNA 074/2008, FAUNA 1299/2008, FAUNA 082/2010, FAUNA 557/2011, FAUNA 638/2012, FAUNA 155/2013, FAUNA 1213/2014, FAUNA 0529/2016, FAUNA 0345/2017, FAUNA 0461/2022).

Description of new species

***Rediviva (Rediviva) parvoides* KUHLMANN nov.sp.** (Figs 1-2, 5-6, 11-13, 17-18, 23-24, 27-28)

D i a g n o s i s : The species belongs to the subgenus *Rediviva* as it displays the defining characters described by KUHLMANN et al. (2020): Females show a combination of a broadened hind tibia and basitarsus with the scopa consisting of densely plumose pubescence, bidentate mandible, inconspicuous apical tergal hair bands, absence of a scale-like projection on the distal-dorsal angle of the hind basitarsus. On S7 males have large strigate translucent lateral lobes, median lobes long and narrow lanceolate to spatulate with pilosity mostly restricted to the apical third, longest hairs about half as long as length of median lobe.

In the key of WHITEHEAD & STEINER (2001) both, females and males, run to *R. parva*. Females of *R. parvoides* and *R. parva* are very similar and can be difficult to distinguish without reference specimens. Especially *R. parva* can be variable (WHITEHEAD & STEINER 2001) (for variation of diagnostic characters see Figs 3-4, 7-10, 14-16, 19-22) and colour features sometimes overlap with *R. parvoides*. Particularly in females they can be difficult to interpret without reference specimens, so a combination of characters should be used. To facilitate identification specimens of both species from neighbouring populations on the Bokkeveld plateau are imaged in same scale (*R. parva*: Farm Papkuilsfontein. *R. parvoides*: Farms Zoetfontein (♂♂) and Avontuur (♀♀)) and displayed in parallel for direct comparison.

Diagnostic characters and their variation in both sexes are summarized in Tab. 1.

Tab. 1: Diagnostic characters of *Rediviva parva* and *R. parvoides* nov.sp. (**bold**: Most reliable and least variable characters).

<i>R. parva</i> ♀♀	<i>R. parvoides</i> ♀♀
<u>T1-T4</u> : Apical tergal hair bands light yellowish-brown or at least with a slight yellowish tinge (Figs 3, 7-10)	<u>T1-T4</u> : Apical tergal hair bands whitish (Figs 1, 5-6)
<u>T1-T4</u> : oily-bluish shine on tergal discs lacking or less intense (Figs 7-10)	<u>T1-T4</u> : oily-bluish shine on tergal discs usually more intense (Figs 5-6)
<u>T5</u> : Prepygidial fimbria appears to be dominantly lighter yellowish-brown ; anterior (covering) blackish-brown hairs sparser and shorter, usually reaching only about half of the length of fimbria, but sometimes about 2/3 of its length or more (Fig. 14)	<u>T5</u> : Prepygidial fimbria appears to be dominantly darker blackish-brown ; anterior (covering) blackish-brown hairs denser and longer, usually almost reaching the end of the fimbria, but sometimes only about 2/3 of its length (Figs 11-12)
<u>T6</u> : Pygidial plate narrower (Figs 15-16)	<u>T6</u> : Pygidial plate broader (Fig. 13)
<u>T6</u> : Pygidial plate variably sculptured: superficially to distinctly punctate (Figs 15-16)	<u>T6</u> : Pygidial plate superficially and indistinctly punctate (Fig. 13)
♂♂	♂♂
<u>Hind tibia & basitarsus</u> : Usually only with light whitish hair, sometimes on apical half dorsally with few brown hairs but these cover less than 1/3 of its lengths (Figs 19, 21)	<u>Hind tibia & basitarsus</u> : On apical half dorsally with dense dark, brown to blackish, hair (Fig. 17)
<u>T1-T5</u> : Apical tergal hair bands light yellowish-brown or at least with a slight yellowish tinge (Fig. 4, see ♀♀)	<u>T1-T5</u> : Apical tergal hair bands whitish (Fig. 2, see ♀♀)
<u>T6-T7</u> : Apical hair fringes variable, orange-brown to blackish brown (Figs 20,22)	<u>T6-T7</u> : Apical hair fringes dark blackish brown (Fig. 18)
Gonostylus: Membrane overall smaller, basally slightly narrower, apically more narrowly rounded (Fig. 25)	Gonostylus: Membrane overall larger, basally slightly broader, apically wider rounded (Fig. 23)
<u>S7</u> : Lateral lobe smaller (Figs 29-30)	<u>S7</u> : Lateral lobe larger (Figs 27-28)
<u>S7</u> : Apical lobe strongly and irregularly arcuate (Fig. 26)	<u>S7</u> : Apical lobe weakly and regularly arcuate (Fig. 24)

Description

Female: Body-length: 11.0-11.5 mm (Habitus: Fig. 1). **Head:** Head wider than long. Integument black except tips of mandible partly dark reddish-brown. Face sparsely covered with long, whitish-grey to yellowish-brown, erect hairs, along inner eye margins, on vertex and antennal scape black hairs intermixed. Clypeus convex in profile, medially with a shallow longitudinal depression, apically impunctate; medially covered with small punctures that become gradually larger and more dispersed apically; surface between punctures shiny. Malar area medially narrow, almost linear. Antenna black, ventrally yellowish-brown. **Mesosoma:** Integument black. Scutal disc between punctures smooth and shiny; scattered ($i = 2-3d$) and finely punctate. Scutum, scutellum, metanotum, mesepisternum and propodeum covered with long yellowish to greyish-white erect hairs, on scutum and scutellum intermixed with black hairs. **Wings:** Membrane yellowish-brown; venation dark brown. **Legs:** Foreleg short, 6.3-6.8 mm (femur to claw). Integument black. Vestiture orange, on femora yellowish-white, scopa orange. **Metasoma:** Integument black. Apical half of T1 covered with long erect yellowish-white hairs, discs of T2-T3 with very short whitish hairs and T4 with very short black hairs; apical tergal hair bands on T2-T4 whitish and well developed (Figs 5-6). Prepygidial fimbria dominantly dark blackish-brown; anterior (covering) blackish-brown hairs dense and long, usually almost reaching the end of the fimbria, but sometimes only about 2/3 of its length (Figs 11-12). T1-T4 almost impunctate or with minute and scattered punctation, polished and with an intense oily-bluish shine (Fig. 6). Pygidial plate broad, superficially and indistinctly punctate (Fig. 13).

Male: Body-length: 10.5-11.0 mm (Habitus: Fig. 2). **Head:** Head slightly wider than long. Integument black except tip of mandible partly dark reddish-brown. Face densely covered with long, white, erect hairs intermixed with black hairs along the inner eye margins and on the vertex. Malar area medially narrow, almost linear. Antenna black. **Mesosoma:** Mesoscutal disc between punctures smooth and shiny; scattered ($i = 2-3d$) and finely punctate. Scutum, scutellum, metanotum, mesepisternum and propodeum covered with long yellowish-white to white erect hairs, on scutum and scutellum intermixed with black hairs. **Wings:** Membrane yellowish-brown; venation dark brown. **Legs:** Integument mostly black, hind tibia and tarsus yellowish-brown. Vestiture mostly whitish, hind tibia and hind basitarsus on apical half dorsally with dense dark, brown to blackish, hair (Fig. 17). **Metasoma:** Integument black. Disc of T1 covered with very long, on T2-T3 with shorter erect white hairs and T3 medially with a spot of short black hairs; discs of T4-T6 with short erect black hairs, laterally with few white hairs. Apical tergal hair bands on T2-T5 white and well developed (Fig. 2). Apical hair fringes on T6-T7 dark blackish brown (Fig. 18). T1-T5 almost impunctate or with minute and scattered punctation, polished and with an intense oily-bluish shine. **Terminalia:** Genitalia (Fig. 23) and S7 (Figs 24, 27-28) as illustrated.

Type material (11 specimens):

Holotype: ♂, South Africa: 12 km NW Nieuwoudtville, Farm Avontuur, Fynbos, 31°16'18''S 19°02'55''E, 770 m, 10.viii.2012, leg. M. Kuhlmann (SAMC).

Paratypes: South Africa: 1♀, 12 km NW Nieuwoudtville, Farm Avontuur, Fynbos, 31°16'18''S 19°02'55''E, 770 m, 6.ix.2009, leg. M. Kuhlmann (RCMK); 1♀, idem, 19.ix.2009 (RCMK); 2♀♀, idem, 3.ix.2012 (1♀ RCMK, 1♀ SAMC); 2♀♀, idem, 3.ix.2016 (RCMK); 1♀, idem, 18.ix.2016 (RCMK); 1♀, idem, 21.ix.2022 (RCMK); 2♂♂, 15 km NW Nieuwoudtville, Farm Zoetfontein E, Fynbos, 31°14'05''S 19°02'50''E, 775 m, 11.viii.2023, leg. M. Kuhlmann (RCMK).

E t y m o l o g y : Named for its similarity with the closely related *R. parva*.

G e n e r a l d i s t r i b u t i o n : Only known from a small area of the Bokkeveld plateau north of Nieuwoudtville that is characterized by Fynbos vegetation on sandy soils.

H o s t p l a n t s : Females apparently only visit *Hemimeris racemosa* (HOULT.) MERR. (Scrophulariaceae) for collecting floral oil.

Discussion

The discovery of *Rediviva parvoides* in the extensively sampled Nieuwoudtville area in western South Africa is a reminder that cryptic species can be hiding even under seemingly well-known taxa in one of the most intensely studied Afrotropical bee genera (e.g. STEINER & WHITEHEAD 1990, 1991, WHITEHEAD & STEINER 2001, WHITEHEAD et al. 2008, KUHLMANN 2012a, b, KUHLMANN & HOLLENS 2015, KUHLMANN et al. 2020, MELIN & COLVILLE 2022). *Rediviva* are large bees and in particular the long-legged females are conspicuous. However, key features for differentiating species are often subtle or even missing at times. In *R. ruficornis* WHITEHEAD & STEINER, 2001 and *R. aurata* WHITEHEAD & STEINER, 2001, for example, males are morphologically indistinguishable while females can be separated only by hair colour (WHITEHEAD & STEINER 2001). Intraspecific colour variation of pubescence and (partial) overlap of characters in closely related taxa as observed for *R. parvoides* and *R. parva* can also pose a challenge for identification. It is a common trait in the genus, like in *R. aurata*, and *R. (Redivivoides) variabilis* (KUHLMANN, 2012) (WHITEHEAD & STEINER 2001, KUHLMANN 2012). Hence, ideally several morphological characters should be used in parallel for *Rediviva* identification, also for discovering possible further cryptic diversity in the genus.

Very little is known about the distribution of *R. parvoides*, but available data suggests that it is restricted to a small area with suitable habitats at the northern extension of the Bokkeveld plateau north of Nieuwoudtville. Between the nearest known occurrences of both species (*R. parva*: Farm Willemsrivier, about 4 km NW Nieuwoudtville; *R. parvoides*: Farm Avontuur) there is an uncollected gap of about 10 km width. So apparently, there is no overlap in distribution with *R. parva* but more fieldwork is required to get information about the range of both species and potential co-occurrences. Situation is similar in the closely related *R. ruficornis* and *R. aurata* that also have unusually small and neighbouring ranges but have never been found in the same site (WHITEHEAD & STEINER 2001).

Although *Rediviva* has been intensively studied in previous decades some taxonomic questions are still pending, highlighting the need for further fieldwork. Only recently the males of *R. steineri* KUHLMANN, 2012 (MELIN & COLVILLE 2022) and *R. (Redivivoides) kamieskroonensis* (KUHLMANN, 2012) (KUHLMANN 2024) were described while the males of *R. transkeiana* WHITEHEAD & STEINER, 2008 (WHITEHEAD et al. 2008) and *R. (Redivivoides) eardleyi* (KUHLMANN, 2012) (KUHLMANN 2012b) still remain unknown.

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Herbarium, South African National Biodiversity Institute, Cape Town, for examination of *Rediviva parva* specimens at the Iziko South African Museum, Cape Town, and to curator Dr. S. Van Noort, for granting access to the collection. Thanks to Northern Cape Department of Environment and Nature Conservation for issuing research and collecting permits.

Zusammenfassung

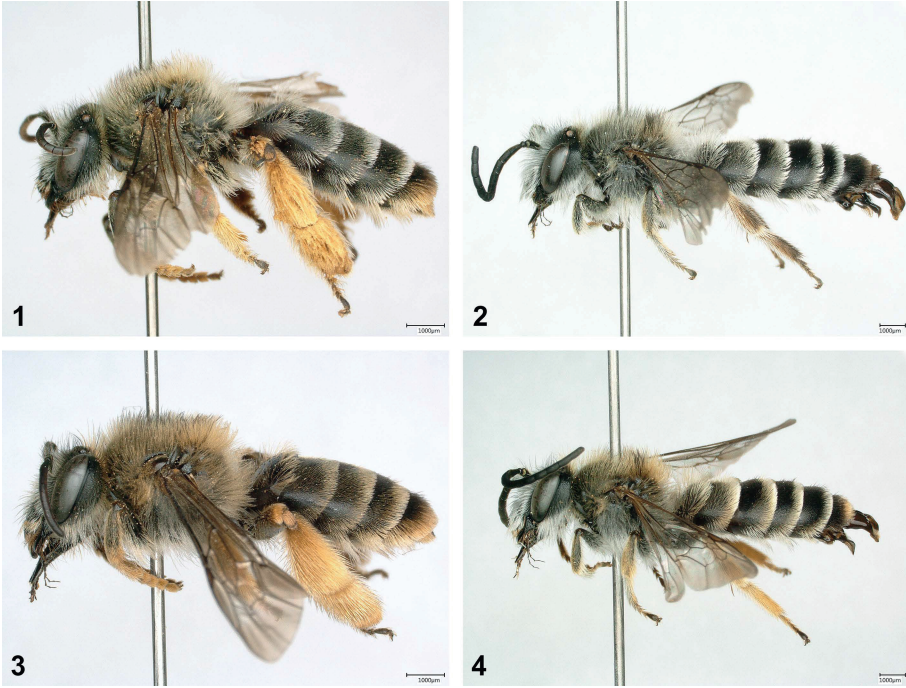
Eine neue in Südafrika endemische, Blütenöl sammelnde Bienenart wird beschrieben: *Rediviva* (*Rediviva*) *parvoides* KUHLMANN nov.sp. ♀♂. Die neue Art und die nah verwandte *Rediviva* (*Rediviva*) *parva* WHITEHEAD & STEINER, 2001 werden photographisch dokumentiert, um ihre Bestimmung zu erleichtern.

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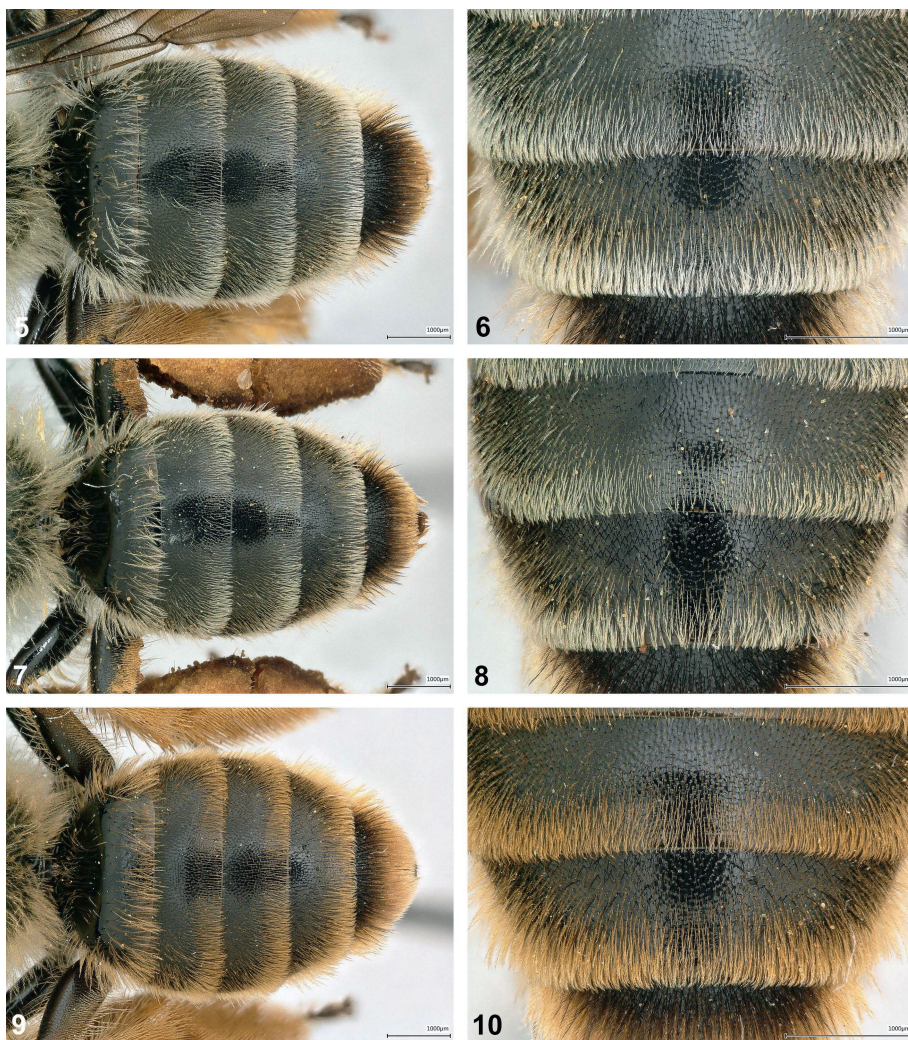
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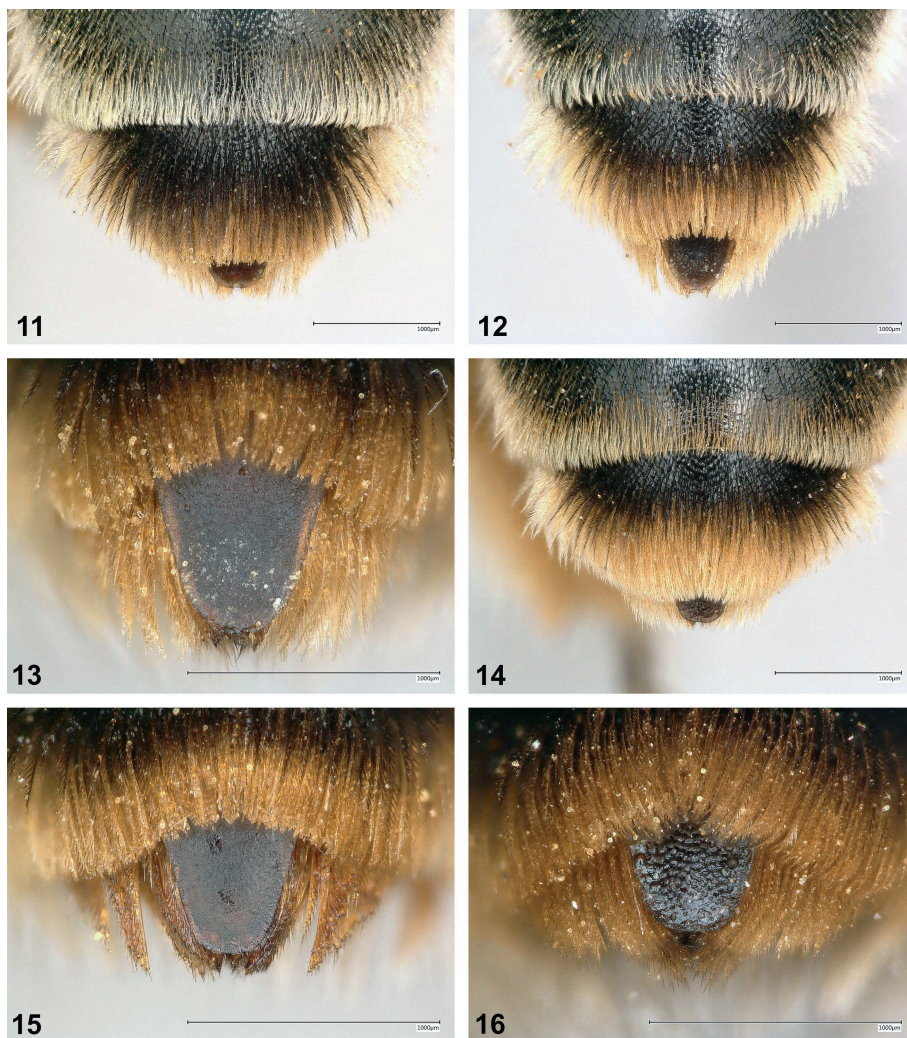
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Figs 1-2: *Rediviva (Rediviva) parvovides* KUHLMANN nov.sp.; (1) ♀, lateral view; (2) ♂, lateral view.
Figs 3-4: *Rediviva (Rediviva) parva* WHITEHEAD & STEINER, 2001; (3) ♀, lateral view; (4) ♂, lateral view.



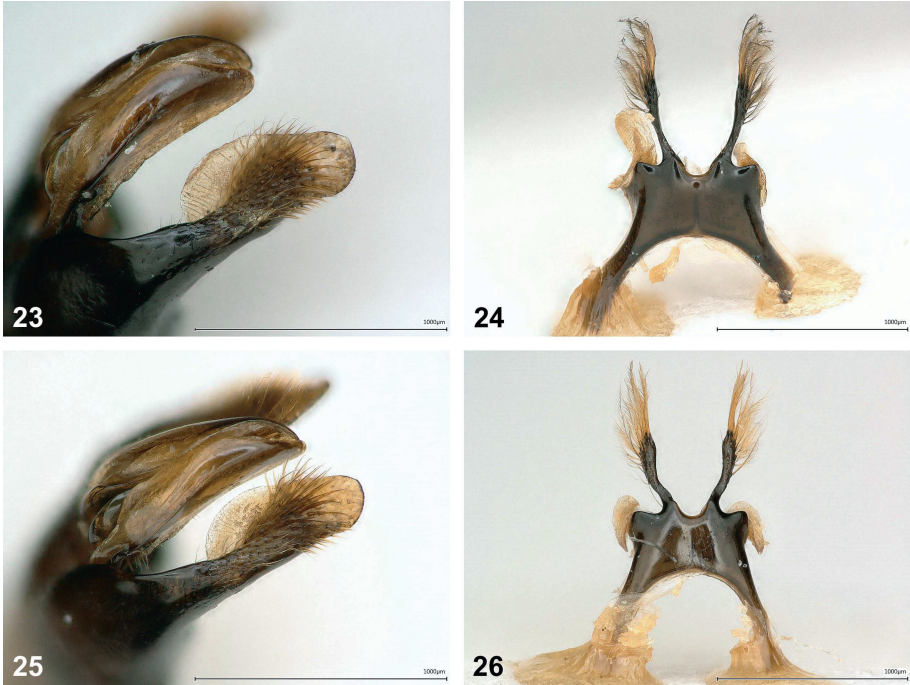
Figs 5-6: *Rediviva (Rediviva) parvoides* KUHLMANN nov.sp., ♀; (5) metasomal apical tergal hair bands whitish; (6) metasomal terga 3-4 with intense oily-bluish shine on discs. **Figs 7-10:** *Rediviva (Rediviva) parva* WHITEHEAD & STEINER, 2001, ♀; (7) metasomal apical tergal hair bands with slight yellowish tinge; (8) metasomal terga 3-4 with slight oily-bluish shine on discs; (9) metasomal apical tergal hair bands light brown; (10) metasomal terga 3-4 without oily-bluish shine on discs.



Figs 11-13: *Rediviva (Rediviva) parvoides* KUHLMANN nov.sp., ♀; (11) prepygidial fimbria mainly blackish-brown (dominant colour morph); (12) prepygidial fimbria lighter, with less blackish-brown hair; (13) pygidial plate. **Figs 14-16:** *Rediviva (Rediviva) parva* WHITEHEAD & STEINER, 2001, ♀; (14) prepygidial fimbria; (15) pygidial plate superficially sculptured; (16) pygidial plate distinctly punctate.



Figs 17-18: *Rediviva (Rediviva) parvoides* KUHLMANN nov.sp., ♂; (17) hind tibia and hind basitarsus; (18) metasomal terga 6-7 with blackish-brown apical hair fringes. **Figs 19-22:** *Rediviva (Rediviva) parva* WHITEHEAD & STEINER, 2001, ♂; (19) hind tibia and hind basitarsus with exclusively light hair (dominant colour morph); (20) metasomal terga 6-7 with mainly light apical hair fringes (dominant colour morph); (21) hind tibia and hind basitarsus on apical half dorsally with few brown hairs; (22) metasomal terga 6-7 with blackish-brown apical hair fringes.



Figs 23-24: *Rediviva (Rediviva) parvoides* KUHLMANN nov.sp., ♂; (23) gonostylus; (24) S7 in dorsal view with apical lobes. **Figs 25-26:** *Rediviva (Rediviva) parva* WHITEHEAD & STEINER, 2001, ♂; (25) gonostylus; (26) S7 in dorsal view with apical lobes.



Figs 27-28: *Rediviva (Rediviva) parvovides* KUHLMANN nov.sp., ♂; (27) S7 dissected, lateral view with membraneous lateral lobe; (28) S7 extracted at specimen, lateral view with membraneous lateral lobe. **Figs 29-30:** *Rediviva (Rediviva) parva* WHITEHEAD & STEINER, 2001, ♂; (29) S7 dissected, lateral view with membraneous lateral lobe; (30) S7 extracted at specimen, lateral view with membraneous lateral lobe.

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